Role of Functional Foods and Beverages

in

Health and Wellness

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ILSI-International Symposium on Diet, Lifestyle & Health at Colombo, Sri Lanka 20-21 Nov 2015
“There is enough space for everybody to grow provided equal opportunity is available”!!

“There is enough space for everybody to grow provided equal SPACE OF OPPORTUNITY is available”!!
FORCES THAT SHAPE THE INGREDIENT MARKET FOR FUNCTIONAL FOODS AND BEVERAGES

- Indigenous material & energy resource
- Socio-Economic imperatives
- Research & Development
- Internal & External markets
- Fiscal policies
- Human Resources
- Trade & Economic blocks
- Cost effectiveness & local sustainability and Sustainable Consumption

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R&D IN THE FUNCTIONAL AND BEVERAGE CHAIN CONTEXT

GOVT.

- Policy Guidelines & Funds
- Revenue/Foreign Exchange
- Consumer Welfare satisfaction
- Welfare, Food Safety & Security
- Welfare, Food & Nutrition Programmes

R&D INSTITUTIONS

- Technologies
- Consultancy
- Trained HR
- Quality Standards
- Policy Matters

PEOPLE

- Technical Inputs
- Research Results
- Ideas

MARKET

- Research results
- Ideas Needs
- New Nutrition Products
- Technology at Field level

Functional Food and Beverage Market

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Economic development and shift in consumption patterns

- Diet/Functional/Organic Foods
- Convenience Foods
- Snacks/Prepared Meals
- Dairy, Meat, Fish, Fresh Fruit Juices, Beverages
- Carbohydrate Staples

Surviving | Mass Market | Convenience Food Service Snacking | Quality Hygiene | High Technology

- Africa (Sub-Saharan)
- India, China, SE Asia, Latin America
- Eastern Europe
- N. America, Japan, W. Europe, Australia

- Ethics
- Chain Quality
- Food Quality
- Food Safety
- Availability
  - Government, laws, choice of suppliers

FAO-2014
The Broader Perspective – Where to Begin ?!

The Huge Market of Nutraceuticals and Functional Foods is the trigger!
Value addition to Ingredients and Quality raw materials is a must to focus in Informal, Organised and Unorganised sector.

The balance between these are very vital in the long run.

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CATCHING THE EXPANDING MARKET!
“Functional foods are foods that have a potentially positive effect on health beyond basic nutrition. Proponents of functional foods say they promote optimal health and help reduce the risk of diseases”
Is this definition enough?!:

“The Functional Foods and Beverages has alarmingly captured large segment of Food market and is expected to reach almost $180 billion by beginning of 2016”

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The New approach, that the Consumer is taking, is to Choose Healthy foods and manage food costs and minimize Medical expenses and this needs to be kept in mind by the Academia and Industry.
Immunity, preventive aspects of diseases, weight management, heart health, bone health and mental health are the concerns of consumers today. Is Functional Food and Functional Beverages the answer??
A growing number of nutraceutical companies are offering ingredients that add health and value to finished Food products.
Foods and Food Ingredients containing phytochemicals with disease preventive claims of Ingredients in Functional Foods and Beverages

On a scale of increasing importance:

- Garlic
- Cabbage
- Licorice
- Soybeans
- Ginger
- Umbelliferae (carrots, celery, parsnips)
- Onions
- Tea
- Turmeric
- Whole wheat
- Flax
- Brown rice
- Solanaceae (tomato, eggplant, peppers)
- Cruciferous (broccoli, cauliflower, brussels sprouts)
- Oats
- Mints
- Oregano
- Cucumber
- Rosemary
- Sage
- Potato
- Thyme
- Chives
- Cantaloupe
- Basil
- Tarragon
- Barley
- Berries

The ladder of Phytochemical Nutrition

Well Documented

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Ingredients + Tradition = Fine Cuisine

(Ultimately it is the Functional Menu that makes a difference)

Ingredients can connect Foods!

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The Biodiversity of a few Traditional & Ethnic Foods in India, Sri Lanka, Japan, China and Vietnam can mean a lot to combinatorial theory of Food ingredients. Complexity of combination of Foods and positive effect on Health?!
Traditional Wisdom (More than 5,000 years of Epidemiological data) to Indian sub Continent and Pacific ocean Countries

Courtesy: Dr Vaidya
Traditional Foods

It is a Treasure of Informatics on Nutrients and Nutraceuticals to prevent diseases and Sustain Recoveries. One of the key points in Traditional Foods and Ethnic Foods in India is derived from Ayurveda which uses mostly Herbs, Spices and Condiments, Fruits and Vegetables. The focus is on method of processing along with a reproducible final product with Bioactives being Bioavailable.

Knowledge of 5000 years of Epidemiological data is an important aspect and cannot be set aside.

Prakash / CSIR-India, 2015
2000 years of Indian documents indicates different Salts going into Beverages and Foods to make it Functional!

<table>
<thead>
<tr>
<th>Salt Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| Rock Salt    | a) saindhava lavana
               vṛṣya
               caṇkuṣya
               vahṣidhiṇa
               trīḍīṣāśāmasa
               vraṇādīṣāvīśāra
               avphrodisiac
               healthy for eyes
               stimulates appetite
               alleviates vitiated dōṣa
               alleviates wounds and diseases caused due to vitiation of dōṣa |
| Sedimented Salt | b) gadha lavana
                  dipana
                  kaphavātāghnasmīrīghnā
                  kṣīyakṣādhanām
                  mālāpaha
                  increases digestive fire
                  alleviates vitiated kapha and vāta and treats piles
                  cleanses internal organs
                  reduces quantity of stools |
| Common Salt  | c) sāmudra lavana
               leghu
               hṛdyā
               paliśirasupitadām
               vidāriti
               kaphavātāghnāma
               dipana
               rucikrt
               light for digestion
               conducive for heart
               causes greying of hairs, vitilages blood
               causes burning sensation
               alleviates vitiated kapha and vāta
               increases digestive fire
               imparts taste |
| Bamboo Salt  | d) draunyea lavana
               lavanya pāke
               nāryugacā
               vidāri
               bhiḍana
               snigdha
               śīlaghna
               amālapitālam
               bamboo salt
               salty in post metabolic effect
               not much hot in potency
               causes burning sensation
               causes breaking of stools
               unctuous
               alleviates pain
               causes gastritis syndrome |
| Black Salt   | e) aukhara lavana
               katu
               kāpāra
               tikta
               vātakaphāpaham
               vidāri
               pittakṛt
               mūtrasamjādkāṃ
               pungent
               alkaline
               bitter
               aggravates kapha and vāta
               causes burning sensation
               aggravates pitta
               reduces urinary output |
| Lake Salt    | f) romaka lavana
               tikṣa
               atyugacā
               katu
               tikta
               dipana
               dāñcaśūkara
               pittakṣākaram
               penetrating
               very hot in potency
               pungent
               bitter
               increase digestive fire
               causes burning sensation and dryness
               aggravates pitta |

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THE NEW TREND

Food not for just Physical health, Preventive aspect and Nutrition but also for Mental Health.

How does one define Mental Health and its Nurturing through Traditional Foods?

The answer may be networking of all disciplines from Traditional Knowledge to Technology thru Traditional & Fermented Foods distilled over 5000 yrs especially in the use of specific, Herbals, Fruits & Vegetables, and Spices for Ingredients
ASIA’S TRADITIONAL KNOWLEDGE & PRACTICES WEBs INTO MODERN SCIENCE.

EMERGENCE OF NEW MODEL FOR REACH OUT OF KNOWLEDGE TO SOCIETY

A true metamorphosis

Prakash / CSIR-India
Integrated approach is the key to success.

Traditional Knowledge + Modern Scientific Support + Rich Epidemiological data in India, Sri Lanka, China, and SE Asia, Africa, and Mediterranean Region.

What a treasure for Functional Foods!?
Specialty Functional Foods

Traditional & Ethnic foods

The Challenge is, compatibility of Food and its preparation in daily Kitchen at Home, in catering and Factories

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DATA BASE ON TRADITIONAL FOODS

The traditional foods are a rich heritage of the world and offer a wide diversity because of their origin in different regions and their multidimensional culture. They have evolved through trial and error over many centuries of cultural, social, economic and sensory experiences.

Scientists to learn traditions which has come in generations and give a supporting role through their scientific knowledge.

The Chemistry of writing on Palm Leaves using Ragi ink and then lacquering them with a base of essential oils from spices from a base of Sesame oil to preserve them forever is simply a marvel of Chemistry.

Do we understand the benefits of combination of different Foods & Ingredients? We must tap this knowledge with the credit of sharing.
Curcumin
as
“Curcumin”!
Thalidomide teams up with turmeric

Hybrid compound can kill blood cancer cells

Cancer researchers in the US and China have combined the turmeric spice pigment curcumin and the drug thalidomide to create hybrid compounds that can kill multiple myeloma cells.

Multiple myeloma is the second most common type of blood cancer, killing 20% of affected patients each year. The drug thalidomide, banned after causing birth defects when given during pregnancy in the 1950s, was recently approved for the treatment of multiple myeloma. Thalidomide works by disturbing the microenvironment of tumour cells in bone marrow. However, it disintegrates in the body. Curcumin, a yellow pigment from the common spice turmeric, is also active against cancers, including myeloma, but is limited by its poor water solubility.

Shijun Zhang at Virginia Commonwealth University, US, and colleagues have synthesised compounds combining structural features from both thalidomide and curcumin. ‘The hybrids have enhanced solubility and higher toxicity against myeloma cells than curcumin, thalidomide, or a mixture of both,’ explains Zhang, ‘so our design rational is going in the right direction.’ Zhang says the hybrids kill myeloma cells through combined mechanisms of action that include the generation of reactive oxygen species and cell cycle inhibition.

‘The advantage of the hybrid compounds is that they are stabilised, and do not degrade in the body as thalidomide does,’ says William Douglas Figg from the National Cancer Institute in Bethesda, US, who has conducted numerous studies with thalidomide derivatives. However, from his experience, compounds considered for further trials should be more toxic to myeloma cells.

In the meantime, one of Zhang’s hybrid compounds has shown activity against myeloma and prostate cancer in animal models. Sonja Hampel

REFERENCE
Diabetes, heart disease and other non communicable diseases and CVDs are rapidly emerging as THE major causes of death in most of the Obesing Economies!
Food and Nutrition as Medicine in Urban World-
A Challenging task and a more challenging task in Rural reachout

Prakash / CSIR-India
The challenges facing scientists in institutions, industry and public health agencies who have the responsibility of assuring a safe, Ingredients supply chain are enormous and, at the same time, demanding high Science with deeper and wider Knowledge base.
1. Food for Celiac patient

- Only treatment for celiac disease is a gluten-free diet (GFD)
  - Strict, lifelong diet
  - Avoid:
    - Wheat
    - Rye
    - Barley

The need of Functional Foods
(Just in India 10 million Celiac patients reported)

Prakash / CSIR-India, 2015
2. HEALTH ISSUES IN SOUTH AND SOUTH EAST ASIA

- Severe Malnutrition
- Child undernutrition (Stunting)
- Different forms of malnutrition
- High infant mortality rate, Approximately 1.72 million children die each year before turning one
- Poor sanitation
- Female health issues
- Rural health
- Chronic diseases
- Malaria, TB, other infectious diseases
- Cancer and HIV
- CVD
- NCD’s
- Obesity

All these require Specialty Functional Foods and Beverages

Prakash / CSIR-India, 2015
3. Inborn Errors of Metabolism (IEM) and need of Specialty diet (PKU)
4. Diabetes, heart disease and other non-communicable diseases are rapidly emerging as the major causes of death in most of the Obesing Economies! Do we have a quick remedy for this?

*Can Functional Foods and Beverages fill this gap?*
The New approach that the Consumer is taking is to Choose Healthy foods and manage food costs and prevent Medical expenses need to be kept in mind.

Drugs are expensive! But not possible to avoid.

India may have cheaper drugs compared to global prices but not cheap enough for the unaffordable even generics especially for the Inborn Errors of Metabolism (IEM) Population

Need of the hour is FSMP & FSDU Functional Foods and Beverages.
• *Is Ingredients the answer??*

• Science based evidence for utility of ancient Safe Ingredient knowledge
Travel of

% → ppm → ppt → nano → femto

Should Analytical limits dominate the Safety rather than Physiology of Ingredients?
Value Addition to Ingredients through the path of Chemistry!

Growing opportunities with Nutraceuticals!
A great Market ahead!

Prakash / CSIR-India
Consumers are deeply concerned about how their health care is managed, administered and priced. They are frustrated with the expensive, high-tech, disease-treatment approach predominant in modern medicine. The consumer is seeking complementary or alternative beneficial products.
Chemistry and Science of Functional Foods and Beverages
The idea of Soup!
Food Technology, Nutrition, Health Foods and Nutraceuticals.

Food Safety has to be based on sound Food Science approach.

(How much they are related?)
Example:

(Paddy Husk)
RICE BRAN AND ITS BYPRODUCTS

RICE BRAN (100%)

PELLETIZATION

SOLVENT TREATMENT

CRUDE RBO (20%)

DEFATTED BRAN

FOOD AND FEED APPLICATIONS

DEWAXING

DEWAXED OIL

WAX – SLUDGE (0.8%)

DEGUMMING

DEGUMMED OIL

GUM- SLUDGE

ALKALI TREATMENT

REFINED OIL

SOAP-STOCK

BLEACHING & DEODORIZATION

VITAMIN E

STEROLS

REFINED RICE BRAN OIL (13-14%)
(COOKING PURPOSE)

WAX

OIL

TRIACONTANOL (0.04%)

LECITHIN (0.4%)

ORYZANOL (0.4%)

FATTY ACIDS (1.2%)

Upgrade Technologies, Reduce input costs, Market savvy products, New & Cost effective Technologies

Create more Job Opportunities both Direct & Indirect

Intervention of High Science and Technology To use These Ingredients

Prakash / CSIR-India
Several terms used in commerce for Health Foods

- Nutraceutical Supplements
- Medical Foods
- Functional Foods
- Foods for Special Dietary Uses
- Less Fat, Less Cals and Less Carb Foods

Prakash / CSIR-India, 2015
Innovation in Ingredients is the need of the hour!?
Nanoparticles are attractive delivery systems for nutrients.

Some of the nanoparticle delivery systems are:

A. Microemulsion
B. Liposome
C. Nanoemulsion
Functional Beverages claim goodness from pediatrics to geriatrics but sometimes goes overboard in Advertisement!?
Natural ingredients in Functional Beverages

Coconut Water Concentrate

Replace filler juices with nutritious coconut water

- 100% Juice
- Low in calories
Some latest in beverage Processing.....

Combines radial jet and coaxial injection for efficient addition and mixing of Powders and concentrates in functional beverages production

Cottle Can, as beverage brands seek packaging differentiation of Functional Foods stability
Food Safety

- Ingredients
- Functional Foods
- Functional Beverages
- RDA
- Nutrients and Nutraceuticals that go with FF and FB
Safe Ingredients is the key for Designer and Functional Foods

WHAT ARE SAFE INGREDIENTS?
The Food Safety system must have **FOUR KEY** attributes to achieve its objectives:

1. Prevention
2. Accountability
3. Integration in the Chain
4. Risk Assessment

The Ingredients Chain passes these challenges many a times we fail to recognise as we take it for granted!
Build R&D continuously to be on the Cutting Edge of Technology for Food Safety
The Safety Chain of Ingredients

- Raw materials and INGREDIENTS
- Packaging
- Process activities
- Temperature and time profile
- Equipment design
- Redesign dynamically
- Storage conditions
- Distribution
- Waste handling
- of course HRM
How can Food Safety barriers to trade be mitigated so that gains from food trade can be better realized still ensuring Safe Food for consumer?
• RISK Assessment (very complex) for *Ingredients*

Industry must be more proactive in this area than ever before.

Risk Assessment has to be a thorough job too.
To deliver Safe Ingredients with

- Zero contamination of Pesticides,
- Zero contamination of Heavy metals
- Absence of toxins and no pathogens
- The quality of water used in ingredients making is also important and is the Real Challenge
It is time for a revolutionary approach in nutrition to understand how foods interact at *cellular level* among individual genotypes and how ingredients interact?.
Information (annotation) associated with a single gene. The marvel of Chemistry in the physiology! The depth of which is still unexplored in Ingredients.

- Phylogenetic relationships
- Genome location
- Gene expression information
- Metabolic map connections
- Metabolic map locus
- Numerical values
- Gene clusters
- Raw images
- Networks

Gene

- Sequence tags
- Sequence
- Structure
- Raw data
- Structure annotation
- Functional chemistry
- Experimental data
- Function
- Pathways

Prakash / CSIR-India
Functional Pre and Pro Biotics has a major role in changing the fingerprint of Gastrobio
Combining science and food is not new. For decades, the food industry has used food science and technology to decrease food borne disease, process and preserve perishable items, and provide wholesome food. But now that food safety and food preservation have become fairly routine - and resulted in mass-produced items that rarely titillate all the senses - a comparatively new application of science to food has emerged: *Molecular Cooking!*
• Personalized diet is already emerging based on an individual’s Genetic code.

• This diet can then lessen the risk of certain diseases which that individual may be susceptible including CVD and Diabetes.

• Studies focusing on the health benefits of ingredients may help pave the way for this new approach of Nutrigenomics through Functional Foods.
In an interdependent world, knowledge sharing and knowledge costing is unavoidable.
Quality Ageing

healthy ageing

Making 60 the new 40

Prakash / CSIR-India, 2015
"Nurture your Genes Naturally and Help it Function Better with Nutraceuticals and Ayurnutraceuticals"
Healthy Diet with Bioactive Ingredients making it Functional Food and Functional Beverages.

Reverse Nutraceuticals and Nutritionals

PHARMACOGENOMICS

GENOME:
DNA sequences &
Single nucleotide polymorphisms (SNPs)

BIOINFORMATICS

TRANSCRIPTION:
Patterns of gene expression

PROTEOMICS:
Structure and function of proteins

Metabolite profiles and functions

METABOLIC OUTCOMES:

Food Safety and Health

Food Safety

Food

MOLECULAR MEDICINE

Healthy Diet

BIOTECHNOLOGY

COMPLEXITIES OF SCIENTIFIC DISCIPLINES INTERACTING AND INTERFACING WITH MODERN MANAGEMENT TECHNIQUES FOR TOMORROWS MULTIDISCIPLINARY APPROACH TO HEALTH & WELLNESS THROUGH BIOACTIVE INGREDIENTS

Biotechnology

Pharmacogenomics

Gene Function & Phenotype

Nutrition

Prakash / CSIR-India

Complexities of scientific disciplines interacting and interfacing with modern management techniques for tomorrow's multidisciplinary approach to health & wellness through bioactive ingredients.
Spring in the air. A male house sparrow flies up to a bird box with an insect in its beak to feed its nestlings in Bloomsburg, Pennsylvania. At this time of year sparrows compete with eastern bluebirds, house wrens, tree swallows and other cavity-nesting birds for the nesting boxes erected next to the Columbia County offices. Photo: AP
“…it is important to remember that Culture, Science and Habits with adequate Physical & Mental exercise by Humans co-exist and have a role in improving the Quality of Life and by Global Networking. This can be achieved by way of Health and Wellness knowledge through the power of Herbals, Informatics and Awareness for a Healthy body especially through knowledge sharing of Chemistry and Technology for fighting Hunger, Malnutrition and Diseases through Functional Foods and Beverages.”

- V Prakash, Distinguished Scientist of CSIR-India
“If the agenda of Sustainable Health through Diet, lifestyle changes and Gene Nurturing matters to us, we shall matter More to it through Safe Functional Foods and Functional Beverages in our daily multi component Foods” - V Prakash